

Oct. 30, 1945.

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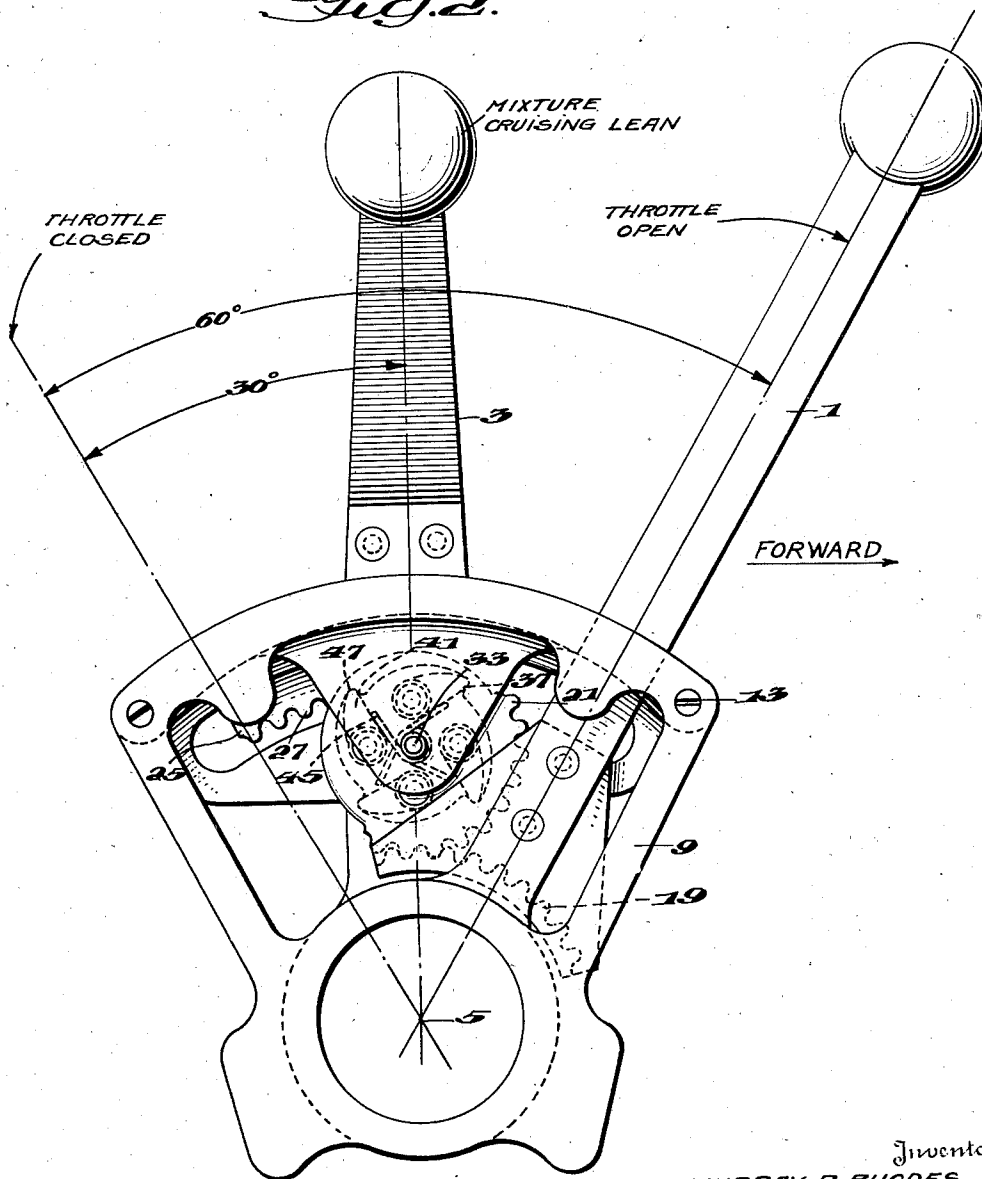
2,388,079

CONTROL LEVER

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Fig. 2.



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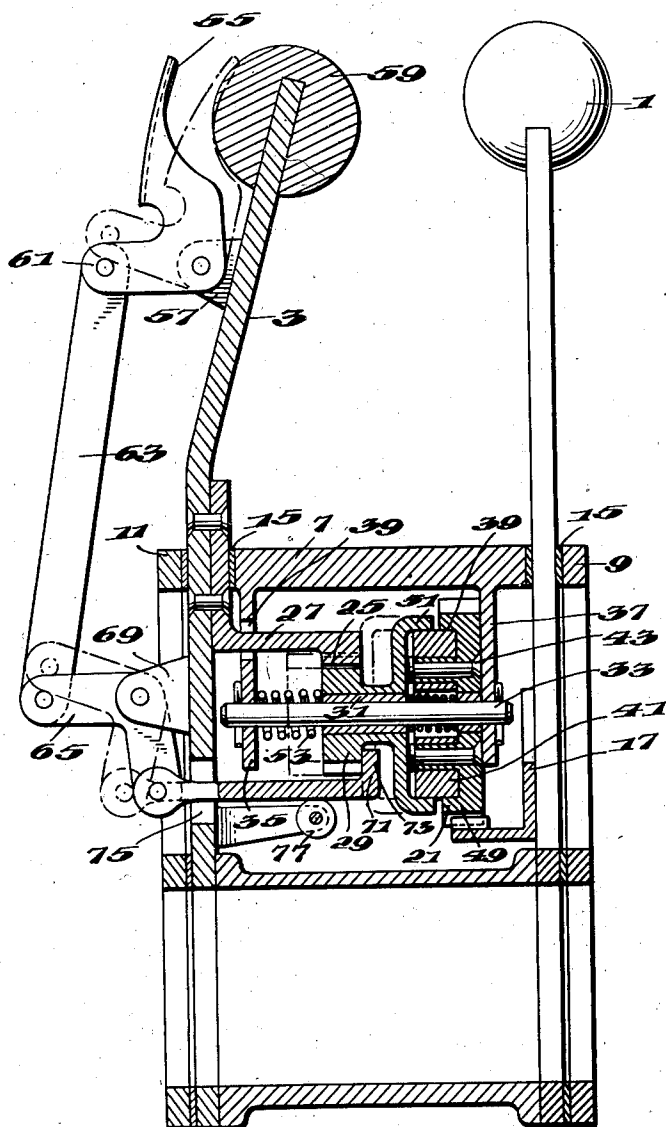
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Fig. 3.



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UNITED STATES PATENT OFFICE

2,388,079

CONTROL LEVER

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Application September 21, 1944, Serial No. 555,071

5 Claims. (Cl. 74—471)

This invention relates to an engine control device, and more particularly to a lever control for the fuel systems of aircraft engines.

An object of the invention is to provide a throttle operating mechanism combined with a mixture control lever for aircraft engines with the two levers so coordinated that it is impossible for the pilot to close the throttle without adjusting the mixture lever to its full rich position. The invention embraces a connecting means for the two levers so that when the throttle is moved to its closed position from its open or cruising position the mixture lever is also moved from its cruising lean position to its full rich position and thereby prevents the engine from stalling if the throttle lever is suddenly moved to its open or cruising position. This movement of the throttle lever does not affect the position of the mixture lever. When it is desirable to set the mixture lever to the cruising lean position, it is done by an intentional effort on the part of the pilot without affecting the position of the throttle lever.

The present invention is an improvement over my prior Patent No. 2,292,091, patented August 4, 1942, and is designed to accommodate mixture levers moving opposite to the throttle levers. In the instant case the throttle lever is connected to the mixture lever by a one-way clutch mechanism and does not use the detachable hooking means for the levers shown in my prior patent. In normal operation when the pilot starts his engine he must choke or provide a rich mixture for his engine and to accomplish this the mixture lever is moved to the desired point to adjust the carburetor to pass a rich mixture to the engine and the throttle lever is opened partially. As the engine warms up the mixture lever can be readily adjusted to prevent overchoking of the engine regardless of the position of the throttle lever. After the plane has taken off and leveled out for cruising the mixture lever is manually adjusted to its cruising lean position, or in other words, to a position near the idle cut-off position. If it becomes necessary for the pilot to retard the throttle, the mixture lever is progressively moved from its lean to its full rich position which is reached as the throttle approaches its closed position. In use, the mixture lever is only adjusted under certain conditions of starting and idling the engine while on the other hand the throttle is manipulated for various operations of the plane. The great danger confronting the pilot is the unintentional cutting down of the speed of the engine without readjusting the mixture control which results in

stalling the engine. This is especially true in military aircraft under battle conditions.

In the drawings:

Fig. 1 is a rear view of the engine throttle and mixture control lever assembly;

Fig. 2 is a front view of the apparatus with the lever positioned as in Fig. 1; and

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 1 and showing the selective connecting means between the two levers.

Essentially the present engine fuel control apparatus consists of a throttle lever 1 and a mixture lever 3 mounted to turn about a common axis 5 within the frame 7, the levers 1 and 3 being carried between arcuate end members 9 and 11, respectively, and the central frame 7 whereby when the levers are moved they adjust the fuel system of the engine through suitable mechanism, not disclosed. As shown, the throttle lever 1 and mixture lever 3 are adapted for individual manual adjustment, the throttle lever being movable throughout the length of the arcuate end segments 9 and 11, or about 60°, while the mixture lever is adjustable over a range of about 35½° from its cut-off to its full rich position, these segments being secured to the ends of central frame 7 by suitable means 13. Preferably, non-metallic separators 15 are used to frictionally hold the levers 1 and 3 in adjusted position.

On the lower portion of the throttle lever 1 an arcuate toothed rack 17 is mounted having teeth 19 thereon normally meshing with the toothed gear 21 as will be hereinafter described.

The mixture lever 3 adjacent the opposite end of the central frame member 7 is provided with a segmental rack 23 having teeth 25 thereon carried on an inwardly extending arm 27 secured to the lower portion of the lever. This toothed segment 23 normally meshes with a gear 29 mounted on bushing 31 and carried on horizontal shaft 33, the ends of the shaft being carried in depending arms 35 and 37 of the central frame 7 and secured in position by cotter pins or the like. The depending arm 35 of the central frame 45 has an arcuate slot 39 therein for the passage of rack arm 27.

The toothed gear 21 meshing with the segmental rack 19 carried by the throttle lever 1 is carried on the end of the horizontal shaft 33 adjacent the depending arm 37 and the inner face of gear 21 is undercut at 39 to provide a flange which limits the outward movement of the plurality of dogs 41, pivoted on the rivets or pinion shafts 43 which are spaced around the undercut face of the gear 21. The pivoted dogs

41 are outwardly projected by spring arms 45 bearing against their long sides into engagement with teeth 47 formed on the inner periphery 49 of toothed gear 21 and the bell-shaped clutch collar 51 integrally attached to the hub of gear 29. These several parts are normally maintained in cooperating relation by compression spring 53 carried on shaft 33 and bearing against the face of gear 29 and the lower portion of depending arm 35.

Thus, when the parts are in the position shown in Fig. 2, that is in normal flight, with the throttle lever 1 "open" and the mixture lever at "cruising lean" and the pilot moves the throttle toward "closed" position the mixture lever 3 is automatically connected to the throttle lever and moves to "full rich" position. This is accomplished by rack 19 meshing with the teeth on gear 21 which is rotated and the movement transmitted to the bell-shaped clutch collar 51 through engagement of the pivoted dogs 41 with the teeth 47 formed in the flange collar to transmit rotary movement to the connected gear 29. The teeth thereon meshing with rack 25 carried by arm 27 and affixed to the mixture control moves the mixture lever 3 backward to "full rich" position so that it is impossible to stall the engine by reducing the fuel thereto without increasing the richness of the mixture. Although there is some lost motion between the parts, it will be noted that due to the use of 4 dogs 41 cooperating with an equal number of rack teeth 47, movement of the throttle 1 can only move a comparatively short distance before a positive clutching occurs and the mixture lever 3 is connected therewith and is carried rearwardly to "full rich." The throttle 1 generally works through an angle of 60° from "open" to "closed" position while the mixture control 3 moves through an angle of 30° from its normal "cruising lean" position (when the throttle is open) to its "full rich" position (when the throttle is closed).

When first starting up it is necessary to permit the mixture lever to have independent movement aside from its tie-in movement with the throttle and this is accomplished by disengaging the clutch collar 51 from engagement with dogs 41. As shown in dotted lines in Fig. 3, when the handle 55 pivoted on stud 57 of the mixture lever 3 is grasped together with the ball 59 on the mixture lever the link arm 61 is elevated and in turn raises arm 63 attached to crank 65 pivoted at 67 to stud 69 and moves horizontal rod 71 passing through opening 75 attached to the lever arm of crank 65 with the lower surface of hook rod 71 suitably supported on a bottom roller 77. The upturned portion 73 of hook rod 71 engages the outer face of gear 29 and disengages it from rack 25 and also moves the clutch collar 51 from engagement with the dogs 41 as shown in dotted lines in this view. Thus the mixture may intentionally move from its closed position to "full rich" or to any desired intermediate point when the pilot presses the printed handle 55 but when the gear train described is in meshing engagement the pilot has only the throttle lever to operate and be assured that he will not stall his engine when he moves the throttle from open to closed position, or from closed to open position.

I claim:

1. In an engine control mechanism, a throttle lever movable between closed and open positions, a mixture control member movable between lean and rich positions and means actuated by the throttle lever comprising a rack adapted to engage a one-way clutch, a pinion mounted coaxial with said one-way clutch to rotate therewith, said pinion meshing with a second rack mounted on said mixture control member so that movement of the throttle from open to closed position rotates said pinion meshing with said second rack to move said control mixture toward its rich position, and manual means secured to the mixture control member for disengaging said pinion and one-way clutch from the said racks.

2. In an engine control mechanism, a throttle lever and a mixture lever mounted to swing about an axis, racks secured to each of said levers and meshing with gears mounted on a common axle, a clutch interposed between said gears and manually operable means on the said mixture lever for disengaging the said clutch whereby the mixture lever may be operated independently of the throttle lever.

3. In an engine control mechanism the combination of a pair of levers mounted to swing about an axis, a clutch, an arcuate rack mounted on each lever, toothed gears connected through said clutch and axially supported on a common axle and adapted to be rotated by one of said racks, and manually operated means pivoted to one of said levers for shifting a portion of said clutch and one of said toothed gears along said axle and out of operable engagement with the other of said toothed gears.

4. In an engine control mechanism, a throttle lever and a mixture lever mounted in an arcuate frame and adapted to swing about an axis, toothed racks carried by said levers and meshing with pinions mounted on a horizontal axle, one of said gears having an enlarged flange collar integrally secured to the hub portion thereof, teeth positioned within the enlarged flange collar, spring biased dogs mounted on the face of the other of said gears normally meshing with the teeth in the said enlarged collar and means for sliding the first mentioned gear and its associated flange collar on the said horizontal axle out of engagement with the rack on the mixture lever and the spring biased dogs on the other of said gears, respectively.

5. In an engine control mechanism, an arcuate frame including a central portion and end plates secured thereto, a throttle lever and a mixture lever mounted between the central frame and the said end plates, spaced depending arms carried on the central frame portion, an axle mounted in said depending arms, gears carried on the said axle meshing with toothed racks carried on the throttle and mixture levers, a one-way clutch mounted for turning about said axle interposed between said gears, the elements of said clutch being carried by said gears and a pivoted lever secured to the mixture lever pivotally secured to a hooked member whereby when said pivoted lever is actuated the hooked member laterally moves one of said gears from engagement with its rack.

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